

WHAT IS CLAIMED IS:

1. A vapor-deposited film comprising a substrate
consisting essentially of a polymer material and a
vapor deposition layer formed on the substrate and
5 consisting essentially of a ceramic material,

wherein the substrate is subjected to a plasma
pretreatment before formation of the vapor deposition
layer on the substrate, by a special plasma using
a hollow anode plasma processing apparatus.

10 2. The vapor-deposited film according to claim 1,
wherein said hollow anode plasma processing apparatus
is a magnetic assisted hollow anode plasma processing
apparatus further comprising a magnet.

3. The vapor-deposited film according to claim 1,
15 wherein the thickness of said vapor deposition layer is
between 5 nm and 300 nm.

4. The vapor-deposited film according to claim 1,
wherein said ceramic material is formed of at least one
inorganic oxide selected from the group consisting of
20 aluminum oxide, silicon monoxide, magnesium oxide and
calcium oxide.

5. The vapor-deposited film according to claim 4,
wherein said inorganic oxide is aluminum oxide.

6. The vapor-deposited film according to claim 5,
25 wherein said aluminum oxide has a gradient structure in
terms of the atomic ratio of aluminum to oxygen such
that said atomic ratio is consecutively changed within

a range of 1 : 2 to 1 : 1 from the side in contact with said substrate toward the surface of the aluminum oxide layer.

7. The vapor-deposited film according to claim 1,
5 wherein said plasma pretreatment is a low temperature plasma treatment carried out by using at least one gas selected from the group consisting of argon nitrogen oxygen and hydrogen, under the conditions that the self bias value is between 200V and 2,000V, and the Ed value
10 defined by "Ed = plasma density x processing time" is between 100 ($V \cdot s \cdot m^{-2}$) and 10,000 ($V \cdot s \cdot m^{-2}$).

8. The vapor-deposited film according to claim 1,
wherein said plasma pretreatment includes a first processing using an inert gas, followed by a second
15 processing, using at least one gas selected from the group consisting of nitrogen oxygen hydrogen, and a mixture thereof.

9. The vapor-deposited film according to claim 8,
wherein said inert gas is at least one selected from
20 the group consisting of argon and helium.

10. The vapor-deposited film according to claim 1,
wherein said plasma pretreatment includes a first processing using a mixed gas consisting of nitrogen and oxygen, followed by a second processing using hydrogen.

25 11. The vapor-deposited film according to claim 1,
wherein said polymer material is at least one polymer selected from the group consisting of polyethylene,

polypropylene, polyamides, polyesters, polycarbonate,
polyacrylonitrile, polystyrene, polyvinyl chloride,
cellulose, triacetyl cellulose, polyvinyl alcohol,
polyurethanes and polymers having chemically modified
5 bodies thereof.

12. The vapor-deposited film according to
claim 11, wherein said polyesters include at least one
polymer selected from the group consisting of
polyethylene terephthalate, polyethylene naphthalate,
10 polybutylene terephthalate, polybutylene naphthalate
and copolymers thereof.

13. The vapor-deposited film according to claim 1,
further comprising a composite covering layer formed on
said vapor-deposited film, consisting essentially of at
15 least one material selected from the group consisting
of a hydrogen radical-containing polymer compound, a
metal alkoxide, a hydrolyzate thereof and a polymer
thereof.

14. The vapor-deposited film according to
20 claim 13, wherein said hydrogen radical-containing
compound includes at least one compound selected from
the group consisting of polyvinyl alcohol, poly(vinyl
alcohol-co-ethylene), cellulose and starch.

15. The vapor-deposited film according to
25 claim 13, wherein said metal alkoxide is selected from
the group consisting of silane alkoxide and a silane
coupling agent.

16. The vapor-deposited film according to claim 1,
wherein said plasma pretreatment and the vapor
deposition of aluminum oxide are carried out
consecutively within the same film-forming apparatus
5 without breaking the vacuum.

17. A vapor-deposited film comprising a substrate
consisting essentially of a polymer material and
a vapor deposition layer formed on the substrate
consisting essentially of aluminum oxide,

10 wherein the substrate is subjected to a plasma
pretreatment before formation of the vapor deposition
layer on the substrate and that the aluminum oxide
layer formed by the vapor deposition has a gradient
structure in terms of an atomic ratio of aluminum to
15 oxygen from the side in contact with the substrate
toward the surface of the aluminum oxide layer.

18. The vapor-deposited film according to
claim 17, wherein said atomic ratio of aluminum to
oxygen is changed within a range of 1 : 2 to 1 : 1 from
20 the side in contact with the substrate toward the
surface of said aluminum oxide layer.

19. The vapor-deposited film according to
claim 17, wherein said plasma pretreatment is a high
frequency plasma treatment.

25 20. The vapor-deposited film according to
claim 17, wherein said polymer material is at least one
polymer selected from the group consisting of

polyethylene, polypropylene, polyamides, polyesters,
polycarbonate, polyacrylonitrile, polystyrene,
polyvinyl chloride, cellulose, triacetyl cellulose,
polyvinyl alcohol, polyurethanes and polymers having
5 chemically modified bodies thereof.

21. The vapor-deposited film according to
claim 20, wherein said polyesters include at least one
polymer selected from the group consisting of
polyethylene terephthalate, polyethylene naphthalate,
10 polybutylene terephthalate, polybutylene naphthalate
and copolymers thereof.

22. The vapor-deposited film according to
claim 17, further comprising a composite covering layer
on said vapor-deposited film, consisting essentially of
15 at least one material selected from the group
consisting of a hydrogen radical-containing polymer
compound, a metal alkoxide, a hydrolyzate thereof and
a polymer thereof.

23. The vapor-deposited film according to
20 claim 22, wherein said hydrogen radical-containing
compound includes at least one compound selected from
the group consisting of polyvinyl alcohol, poly(vinyl
alcohol-co-ethylene), cellulose and starch.

24. The vapor-deposited film according to
25 claim 22, wherein said metal alkoxide is selected from
the group consisting of silane alkoxide and a silane
coupling agent.

25. The vapor-deposited film according to
claim 17, wherein said plasma pretreatment and the
vapor deposition of aluminum oxide are carried out
consecutively within the same film-forming apparatus
5 without breaking the vacuum.